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Lithostratigraphy of the Pondaung Formation (Eocene) between Tabyin and Kyauktakha to the west of Pauk, central Myanmar

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Abstract

Columnar sections of the Pondaung Formation along the Tabyin-Kyauktakha route are measured and described in detail. The Pondaung Formation of the section is composed of sandstone, siltstone and claystone with minor amounts of coal, acidic tuff and gritty-pebbly sandstone. The total thickness of the Pondaung Formation along the Tabyin-Kyauktakha route amounts to ca. 1,170 m. While the Lower Member of the Pondaung Formation contains a large amount of claystone and siltstone sequences, the Upper Member of the formation consists merely of sandstone that exhibits trough-type cross bedding frequently. In contrast to the fossil-bearing Upper Member of the Pondaung Formation in the areas of Pale and Myaing townships, the sandstone sequences of the Upper Member of the Tabyin-Kyauktakha section were deposited under the high energy sedimentary environment that eliminated the preservation of fossil vertebrates.

Zusammenfassung

Entlang des Wegs zwischen Tabyin und Kyauktakha wurden von der kompletten Abfolge der Pondaung-Formation die Säulenprofile erstellt und detailliert beschrieben. Die Pondaung-Formation besteht hier aus Sand-, Silt- und Tonstein mit geringen Anteilen an Kohle, sauerem Tuff und kieshaltigem Sandstein. Die Gesamtmächtigkeit der Pondaung-Formation des Tabyin-Kyauktakha-Profiles beträgt ca. 1.170 m. Während das untere Glied der Pondaung-Formation einen hohen Anteil an Silt- und Tonstein aufweist, besteht deren obere Glied ausschließlich aus Sandstein, in dem häufig trogförmige Schrägschichtungskörper ausgebildet sind. Im Gegensatz zum Wirbeltiere-führenden oberen Glied der Pondaung-Formation in den Gebieten Pale und Myaing wurde die Sandstein-Abfolge des oberen Tabyin-Kyauktakha-Profiles unter hochenergetischen Sedimentationsbe-

dingungen abgelagert, im Rahmen derer es zur Überlieferung von Wirbeltierknochen kaum kommen konnte.

Introduction

The Eocene Pondaung Formation is widely distributed in central Myanmar, and its geology has been studied in some areas. In the areas of Pale and Myaing townships, the Pondaung Formation consists mainly of fluvial deposits and yields the well-preserved terrestrial vertebrate fossils (e.g., Aye Ko Aung, 1999, 2004; Aung Naing Soe, 1999; Aung Naing Soe *et al.*, 2002). On the other hand, the Pondaung Formation in the Minbu district exhibits shallow marine environments (Shwezettaw area; Aung Khin and Kyaw Win, 1969; Maung Maung, 1994). The area studied in this paper is located along a roadside of Tabyin to Kyauktakha to the west of Pauk township (Figure 1). Geographically, this area is located about 70-80 km southwest of the areas of Pale and Myaing townships and about 130-140 km north to north-northwest of the Minbu area. It is expected that the study area lies in the transitional area between the fluvial and shallow marine environments. In addition, the strata of the Pondaung Formation of the study area dips to the east monotonously, so that the whole sequences from the base to top of the formation crop out in a relatively narrow area.

Here we describe a lithologic column of the whole sequences of the Pondaung Formation along the route of Tabyin to Kyauktakha villages to clarify the total thickness and lithostratigraphy of the Pondaung Formation in this area.

Geologic setting

The study area is geotectonically located in the western part of the Inner-Burman Tertiary Basin (Figure 1), in which the Cenozoic fluvial to shallow marine sediments are mainly deposited (Chhibber, 1934; Bender, 1983). In the Inner-Burman Tertiary Basin some sub-basins are recognised, one of which is called the north to south stretching Minbu Basin distributed between the latitudes 20°N and 22°N. The geologic structure of the Minbu Basin is characterised by the Salin Syncline (Bender, 1983), and the study section is situated on its western limb.

Along the road between Kyauktu and Pauk (Figure 1) the Eocene to Quaternary formations are distributed. These formations strike approximately north to south and dip about 40-60° eastwards. The following formations and group are distributed between Kyauktu and Pauk in ascending order: the Eocene Laungshe Formation, the Eocene Tilin Formation, the Eocene Tabyin Formation, the Eocene Pondaung Formation, the Eocene Yaw Formation, the Oligocene Shwezettaw Formation, the Oligocene Padaung Formation, the Oligocene Okhmin-taung Formation, the Miocene Kyaukkok Formation and the Miocene to lower Quaternary Irrawaddy Group (Cotter and Clegg, 1938; IGCP National Committee, 1981). Among the formations, the here described section focuses on the Pondaung Formation that is conformably underlain by the Tabyin Formation and is conformably overlain by the Yaw Formation. The

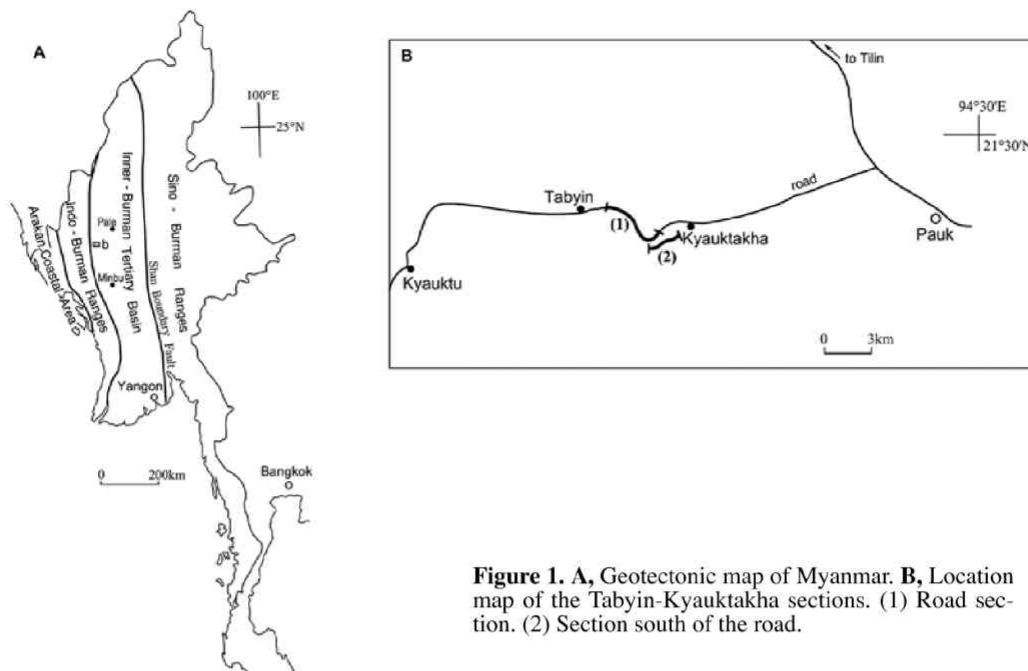


Figure 1. A, Geotectonic map of Myanmar. B, Location map of the Tabyin-Kyauktakha sections. (1) Road section. (2) Section south of the road.

geologic age of the Pondaung Formation are discussed by Aye Ko Aung (1999, 2004) and Tsubamoto *et al.* (2000, 2002, 2006 in this volume) in detail based on the studies in the areas of Pale and Myaing townships, and a Middle Eocene age has been estimated.

Columnar sections between Tabyin and Kyauktakha villages

The geologic columns of the whole sequences of the Pondaung Formation along the Tabyin-Kyauktakha route are shown in Figures 2 to 18. Two sections were measured, the road section and the section south of the road (Figure 1). These two sections are connected at the horizon 670.9 m with the characteristic lithology of the large-scale trough cross stratification with pebbles (Figures 19 and 20). The total thickness of the Pondaung Formation along the measured section amounts to 1,167.5 m. Lithostratigraphic characteristics are summarised as follows.

(1) The Pondaung Formation along the Tabyin-Kyauktakha route is lithologically subdivided into the Lower and Upper Members at the horizon 724.8 m. The thickness of the Lower Member amounts to 724.8 m and that of the Upper Member amounts to 442.7 m. These two members cannot be directly correlated with those of the areas of Pale and Myaing townships (Aye Ko Aung, 1999) because of the lithologic differences.

(2) The Lower Member of the formation is composed mainly of sandstone, siltstone, and claystone sequences. The minor amounts of coal, acidic tuff and gritty-pebbly sandstone are also included in the Lower Member. Two thin acidic tuff layers are intercalated only within the claystone sequences that are accompanied by coal and/or peat beds. These acidic tuff layers will be the clues to correlate with the Pondaung Formation in the fossil-bearing Paukkaung area (see Tsubamoto *et al.*, 2002; Maung Maung *et al.*, 2005; Suzuki *et al.*, 2006

in this volume).

(3) Sandstone beds with the large-scale trough cross bedding and pebbles are appeared at the higher horizon of the Lower Member (around horizon 670 m; Figures 19 and 20).

(4) The Upper Member of the formation consists mainly of thick sandstone sequences that exhibit the sedimentary structures under high energy conditions (e.g., trough-type cross stratification).

(5) Although the Upper Member of the Pondaung Formation in the areas of Pale and Myaing townships yields well-preserved fossil vertebrates, the Upper Member of the formation along the Tabyin-Kyauktakha route yields little vertebrate fossil bones. This is due to the differences in lithology and sedimentary environment. While the Upper Member of the areas of Pale and Myaing townships includes thick claystone sequences that yield rich fossil vertebrates (see Suzuki *et al.*, 2006 in this volume), the Upper Member of the Tabyin-Kyauktakha route is composed mainly of thick sandstone strata that were deposited under high energy currents suggested by the trough-type cross stratification. The sandstones deposited under high energy currents could not make fossil preservation possible.

Acknowledgements

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References

- Aung Khin and Kyaw Win (1969) Geology and hydrocarbon prospects of the Burma Tertiary Geosyncline. *Union of Burma Journal of Science and Technology* 2:52-73.
- Aung Naing Soe (1999) Sedimentary facies of the upper part of the Pondaung Formation (in central Myanmar) bearing late Middle Eocene anthropoid primates. p.152-178. In “*Proceedings of the Pondaung Fossil Expedition Team.*” Pondaung Fossil Expedition Team (ed.) Office of Strategic Studies, Ministry of Defence: Yangon.

- Aung Naing Soe, Myitta, Soe Thura Tun, Aye Ko Aung, Tin Thein, Marandat, B., Ducrocq, S., and Jaeger, J.-J. (2002) Sedimentary facies of the late Middle Eocene Pondaung Formation (central Myanmar) and the paleoenvironments of its anthropoid primates. *Comptes Rendus Palevol* 1:153-160.
- Aye Ko Aung (1999) Revision on the stratigraphy and age of the primates-bearing Pondaung Formation. p.131-151. In “*Proceedings of the Pondaung Fossil Expedition Team.*” Pondaung Fossil Expedition Team (ed.) Office of Strategic Studies, Ministry of Defence: Yangon.
- Aye Ko Aung (2004) The primate-bearing Pondaung Formation in the upland area, northwest of Central Myanmar. p.205-217. In “*Anthropoid origins: new visions.*” Ross, C. and Kay, R.F. (eds.) Kluwer Academic/Plenum Press: New York.
- Bender, F. (1983) *Geology of Burma*. Gebrüder Borntraeger: Berlin. 293pp.
- Chhibber, H.L. (1934) *The geology of Burma*. Macmillan: London. xxviii+538pp.
- Cotter, G. de P. and Clegg, E.L.G. (1938) Geology of parts of Minbu, Myingyan, Pakokku, and lower Chindwin Districts, Burma. *Memoirs of the Geological Survey of India* 72:xl+1-136, pls.1-11.
- IGCP National Committee (1981) Stratigraphic committee field excursion in the Saw, Tilin and Gangaw areas. *Field excursion* no.8, p.1-15, apdx A-D, petrographic descriptions and geological map.
- Maung Maung (1994) *Petrology of the Shwezettaw–Kyauk-Oo–Ngape Area, Minbu and Ngape townships, Magway Division*. M. Sc. Thesis, Mandalay University, Mandalay. 154 pp., 101 figs., 53 tabs., 1 map.
- Maung Maung, Thaung Htike, Tsubamoto, T., Suzuki, H., Chit Sein, Egi, N., Zaw Win, Zin Maung Maung Thein, and Aye Ko Aung (2005) Stratigraphy of the primate-bearing beds of the Eocene Pondaung Formation at the Paukkaung area, central Myanmar. *Anthropological Science* 113:11-15.
- Suzuki, H., Maung Maung, Zaw Win, Tsubamoto, T., Zin Maung Maung Thein, Egi, N., Takai, M., and Shigehara, N. (2006) Stratigraphic positions of the Eocene vertebrate localities in the Paukkaung area (Pondaung Formation, central Myanmar). *Asian Paleoprimatology* 4:67-74.
- Tsubamoto, T., Egi, N., Takai, M., Shigehara, N., Aye Ko Aung, Tin Thein, Aung Naing Soe, and Soe Thura Tun (2000) A preliminary report on the Eocene mammals of the Pondaung fauna, Myanmar. *Asian Paleoprimatology* 1:29-101.
- Tsubamoto, T., Egi, N., Takai, M., Shigehara, N., Suzuki, H., Nishimura, T., Ugai, H., Maung-Maung, Chit-Sein, Soe Thura Tun, Aung Naing Soe, Aye Ko Aung, Tin Thein, Thaung-Htike, and Zin-Maung-Maung-Thein (2006) A summary of the Pondaung fossil expeditions. *Asian Paleoprimatology* 4:1-66.
- Tsubamoto, T., Takai, M., Shigehara, N., Egi, N., Soe Thura Tun, Aye Ko Aung, Maung Maung, Danhara, T., and Suzuki, H. (2002) Fission-track zircon age of the Eocene Pondaung Formation, Myanmar. *Journal of Human Evolution* 42:361-369.

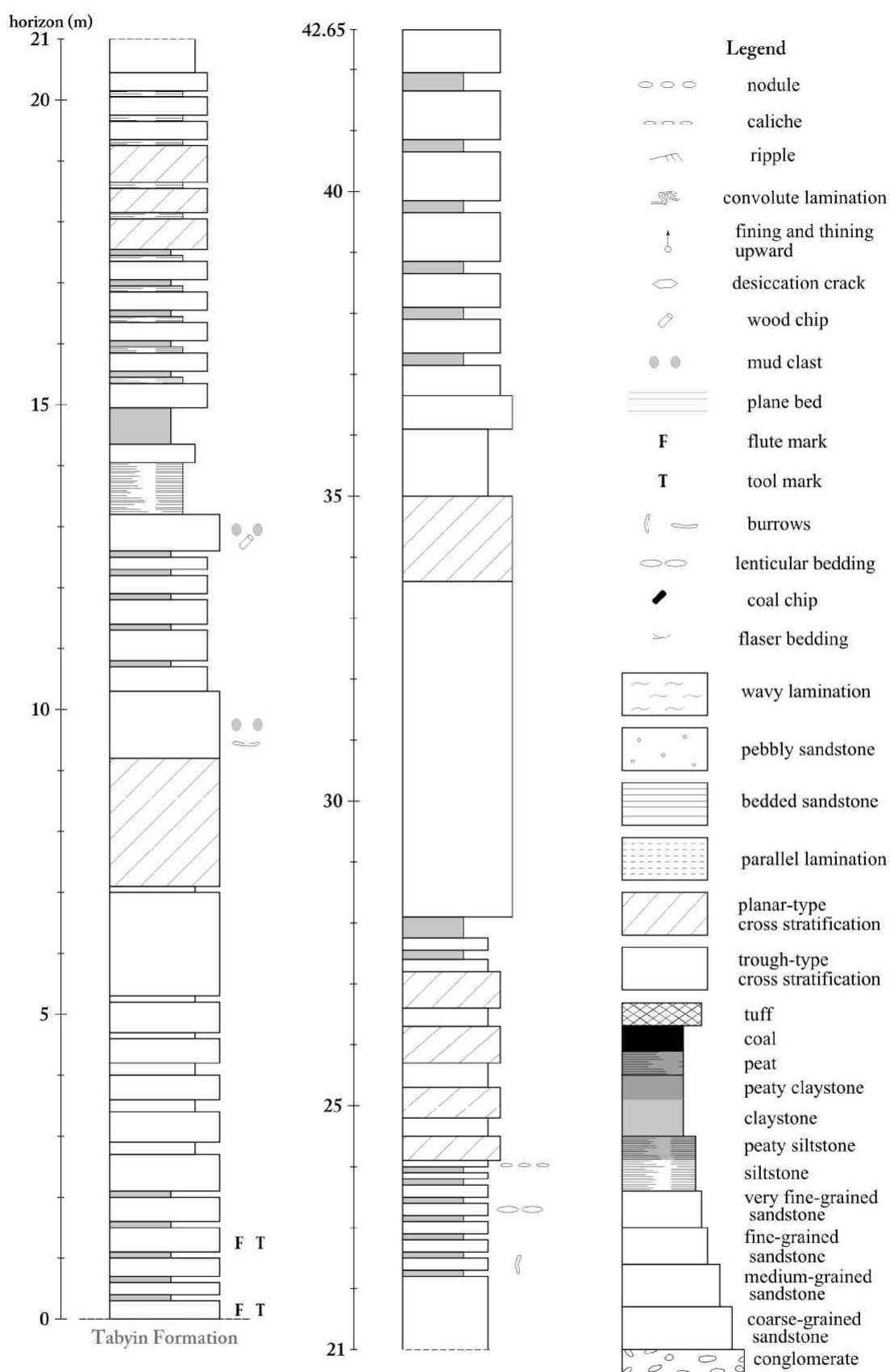


Figure 2. Lithologic column of the Pondaung Formation (1). Basal part of the Pondaung Formation. Road section.

Lithostratigraphy of the Pondaung Formation to the west of Pauk

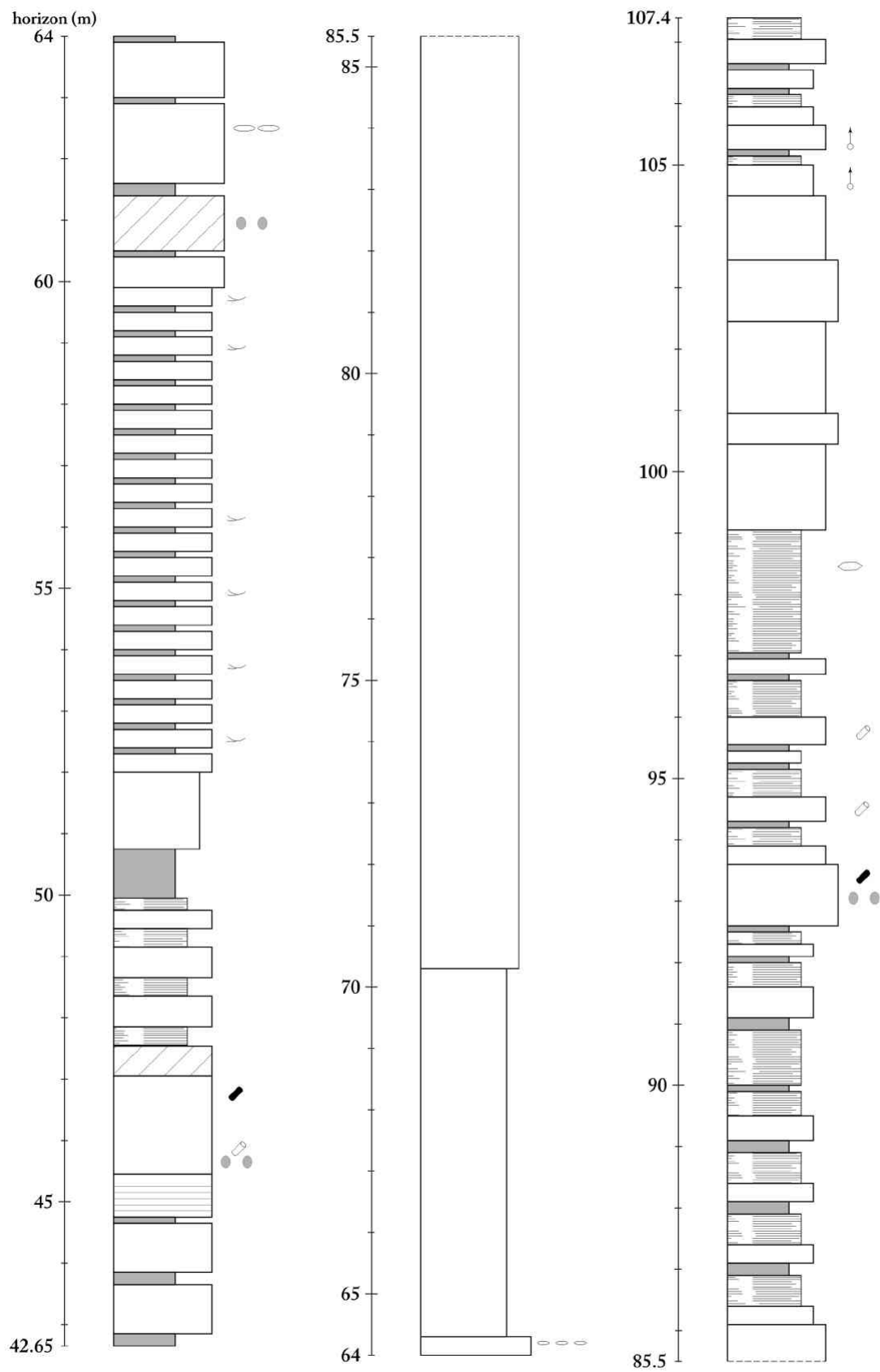


Figure 3. Lithologic column of the Pondaung Formation (2). Road section. Legend is the same as Figure 2.

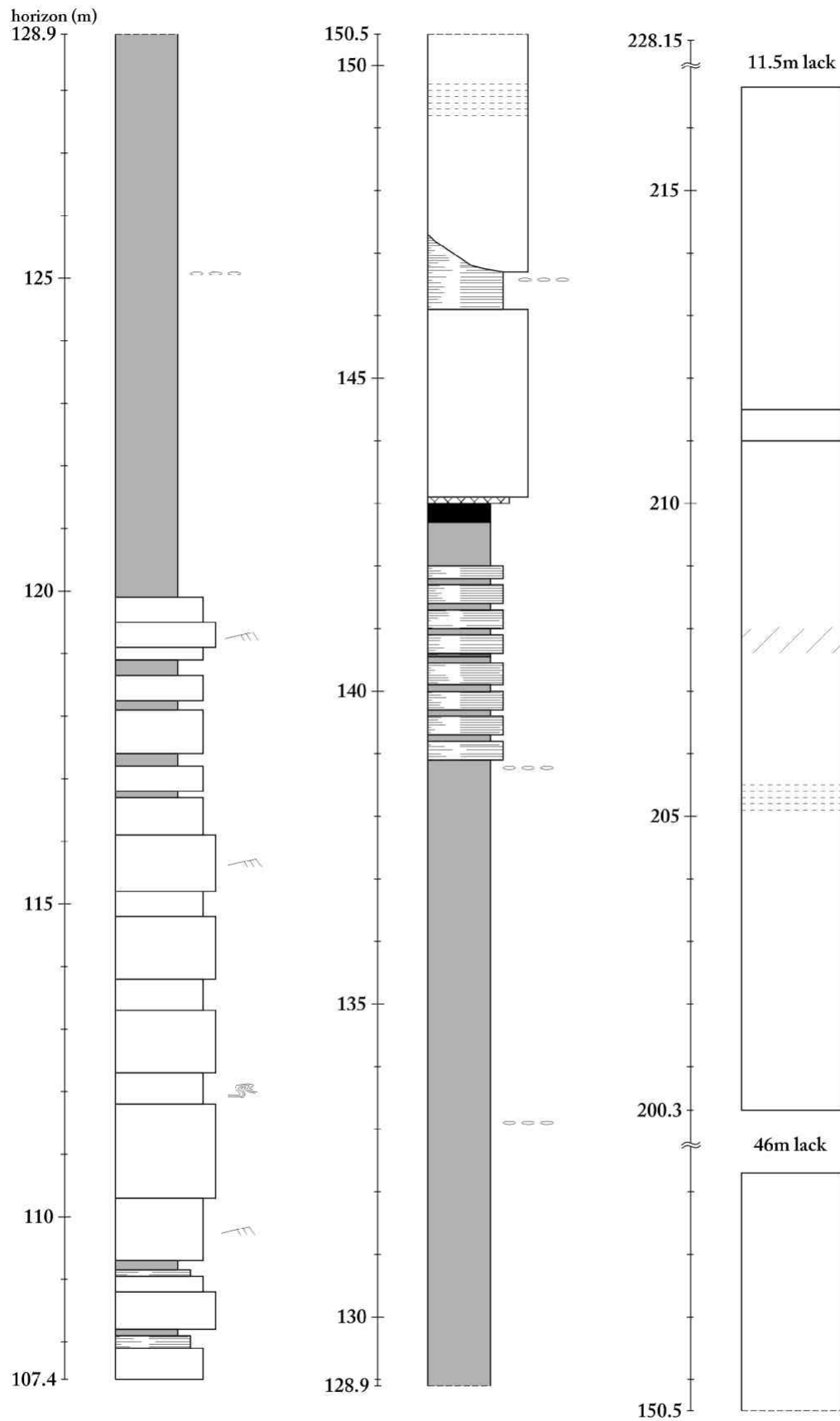


Figure 4. Lithologic column of the Pondaung Formation (3). Road section. Legend is the same as Figure 2.

Lithostratigraphy of the Pondaung Formation to the west of Pauk

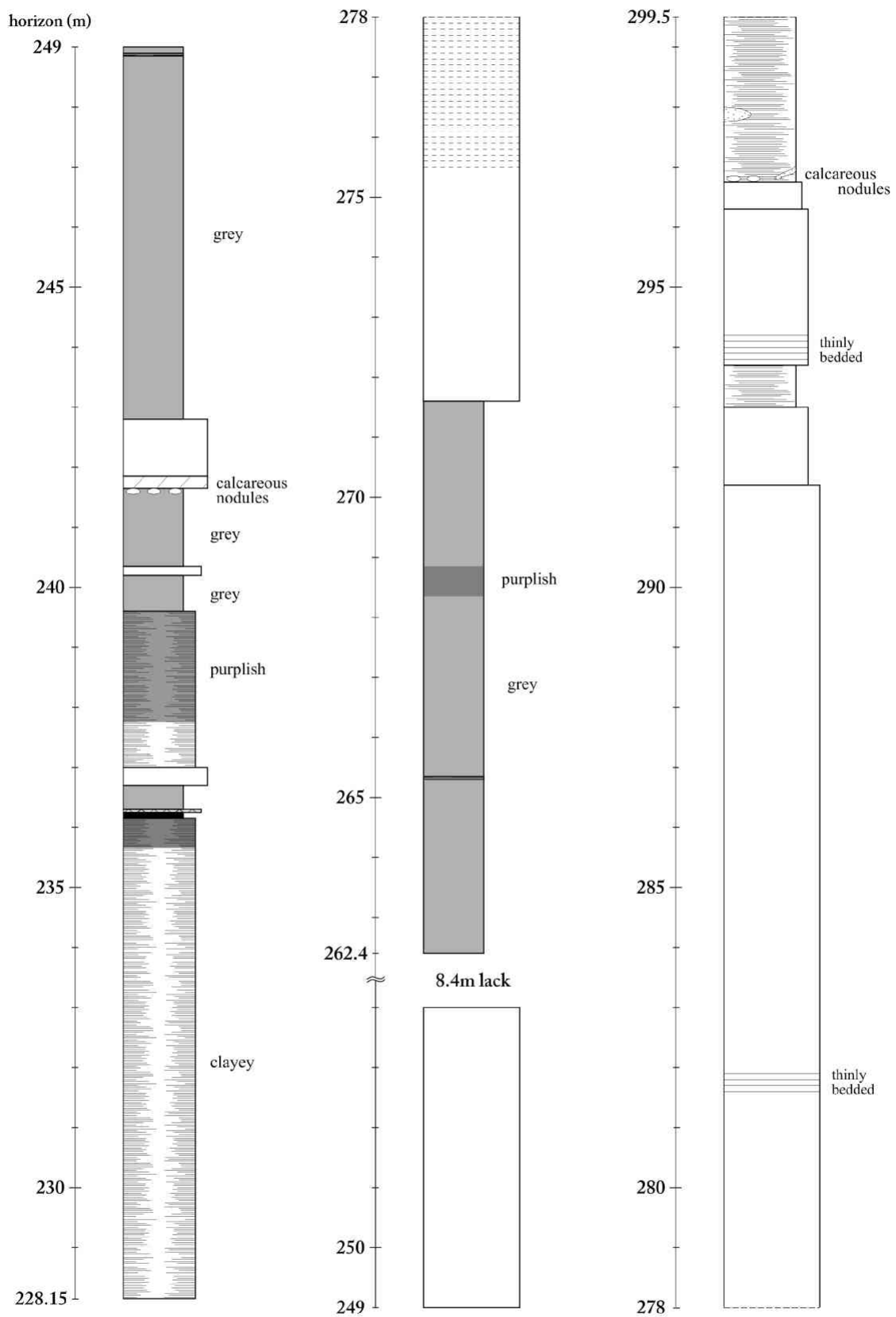


Figure 5. Lithologic column of the Pondaung Formation (4). Road section. Legend is the same as Figure 2.

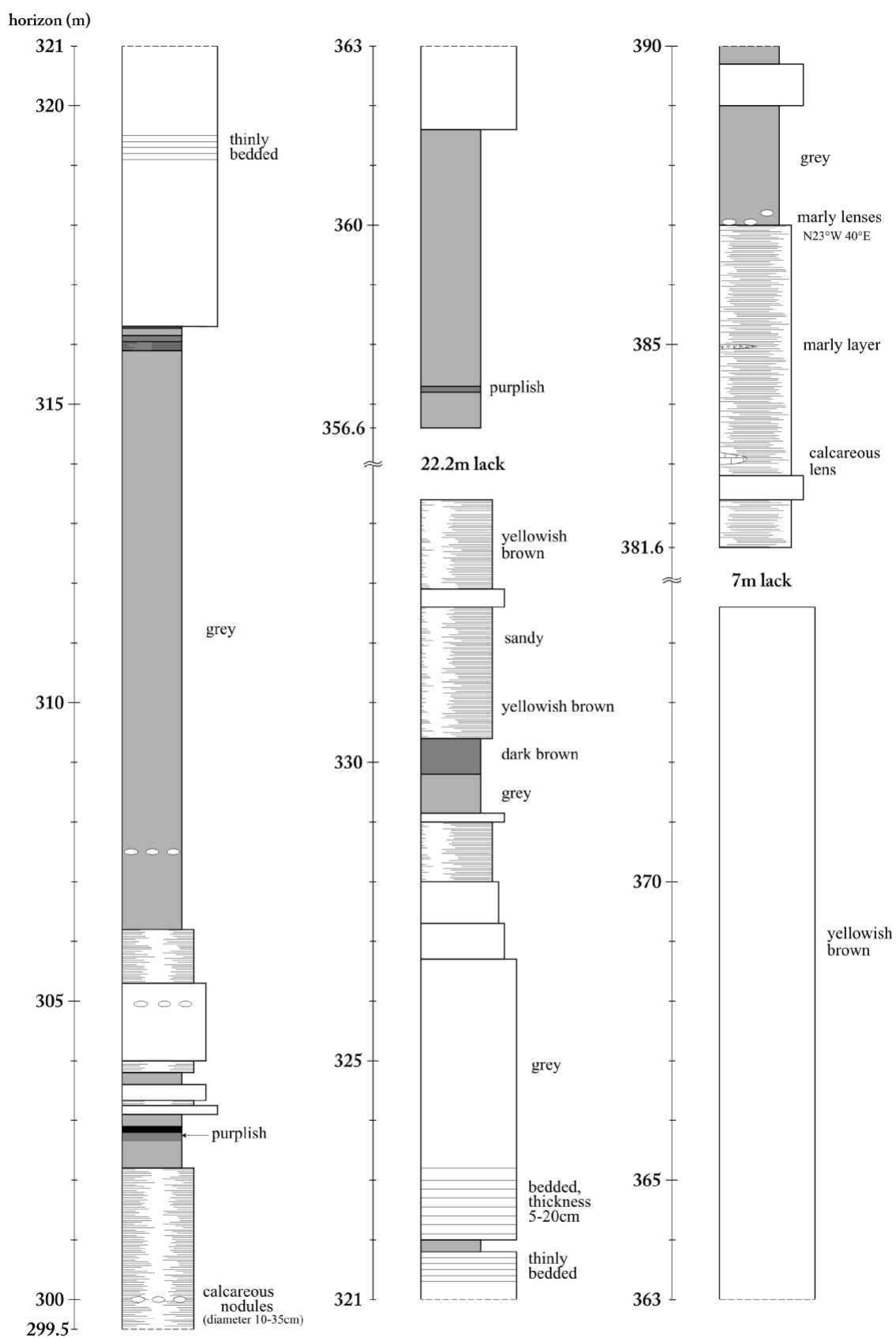


Figure 6. Lithologic column of the Pondaung Formation (5). Road section. Legend is the same as Figure 2.

Lithostratigraphy of the Pondaung Formation to the west of Pauk

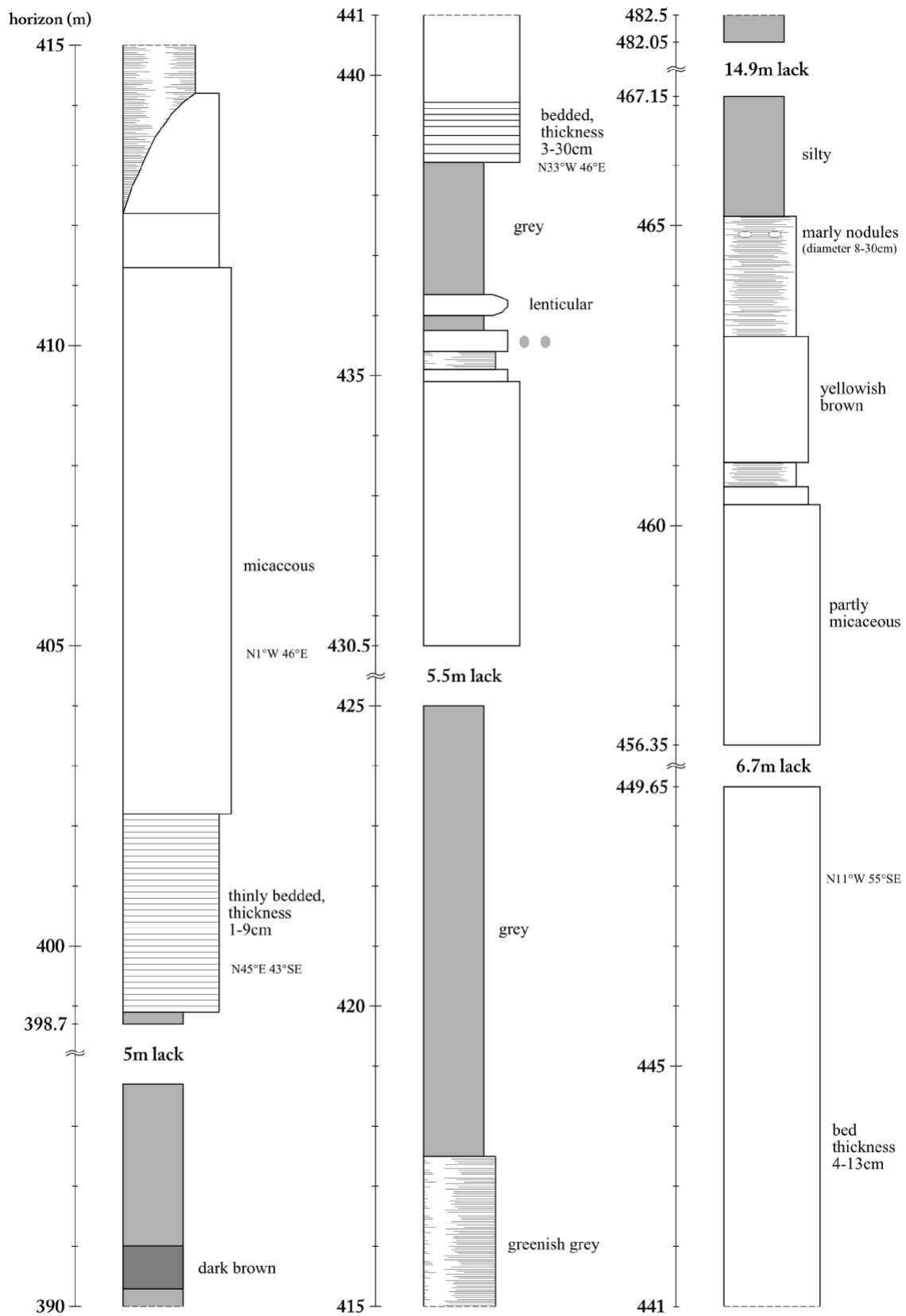


Figure 7. Lithologic column of the Pondaung Formation (6). Road section. Legend is the same as Figure 2.

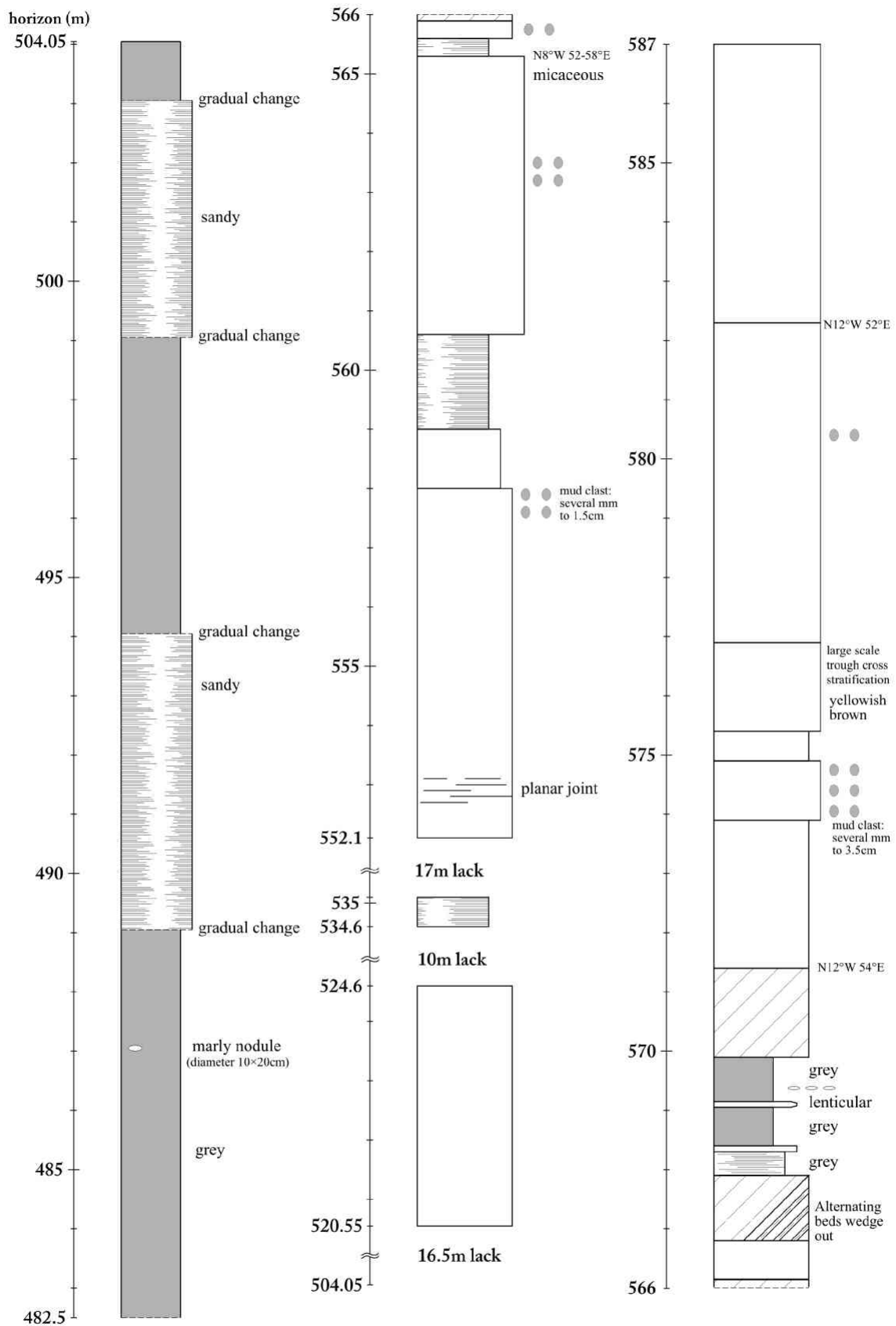


Figure 8. Lithologic column of the Pondaung Formation (7). Road section. Legend is the same as Figure 2.

Lithostratigraphy of the Pondaung Formation to the west of Pauk

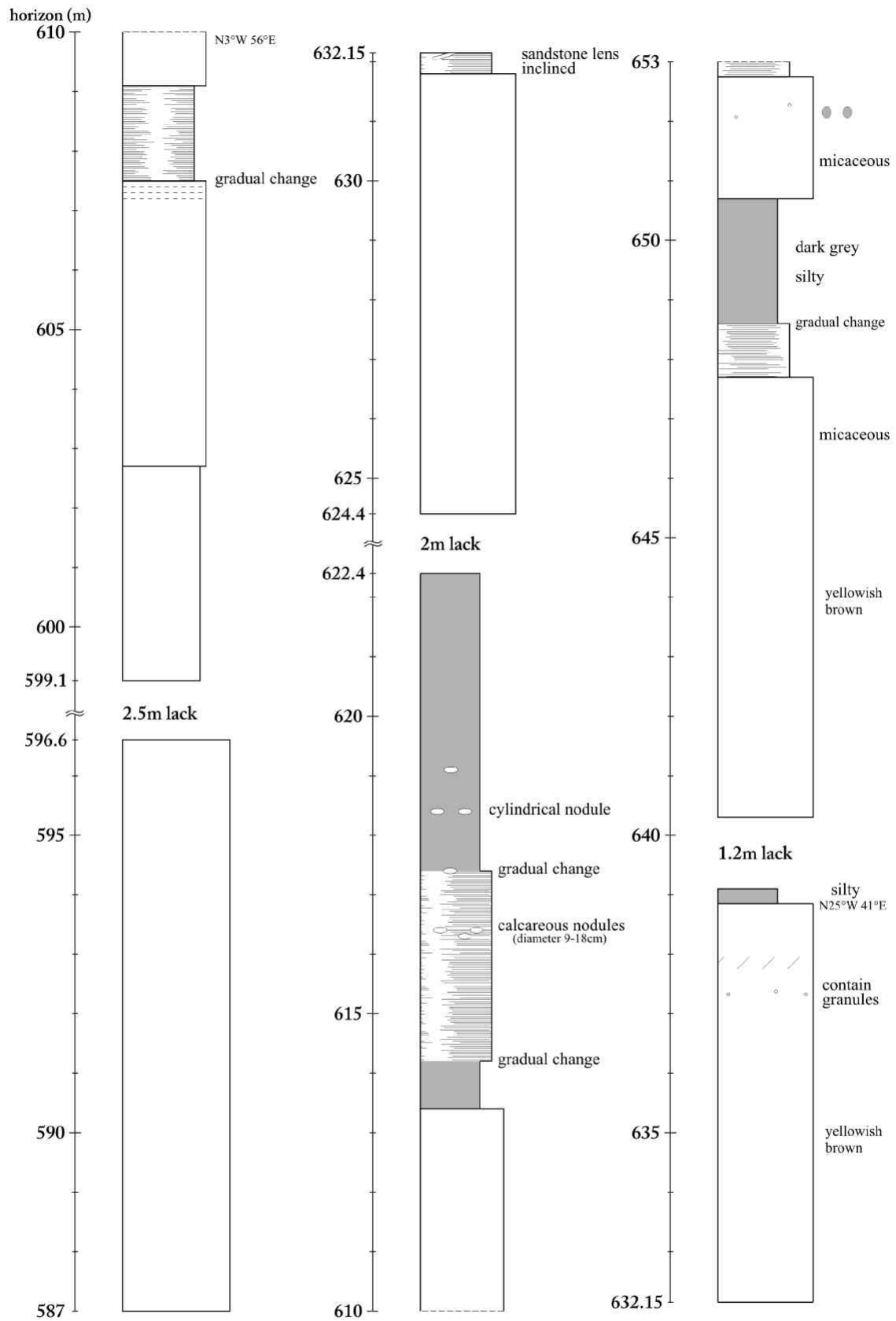


Figure 9. Lithologic column of the Pondaung Formation (8). Road section. Legend is the same as Figure 2.

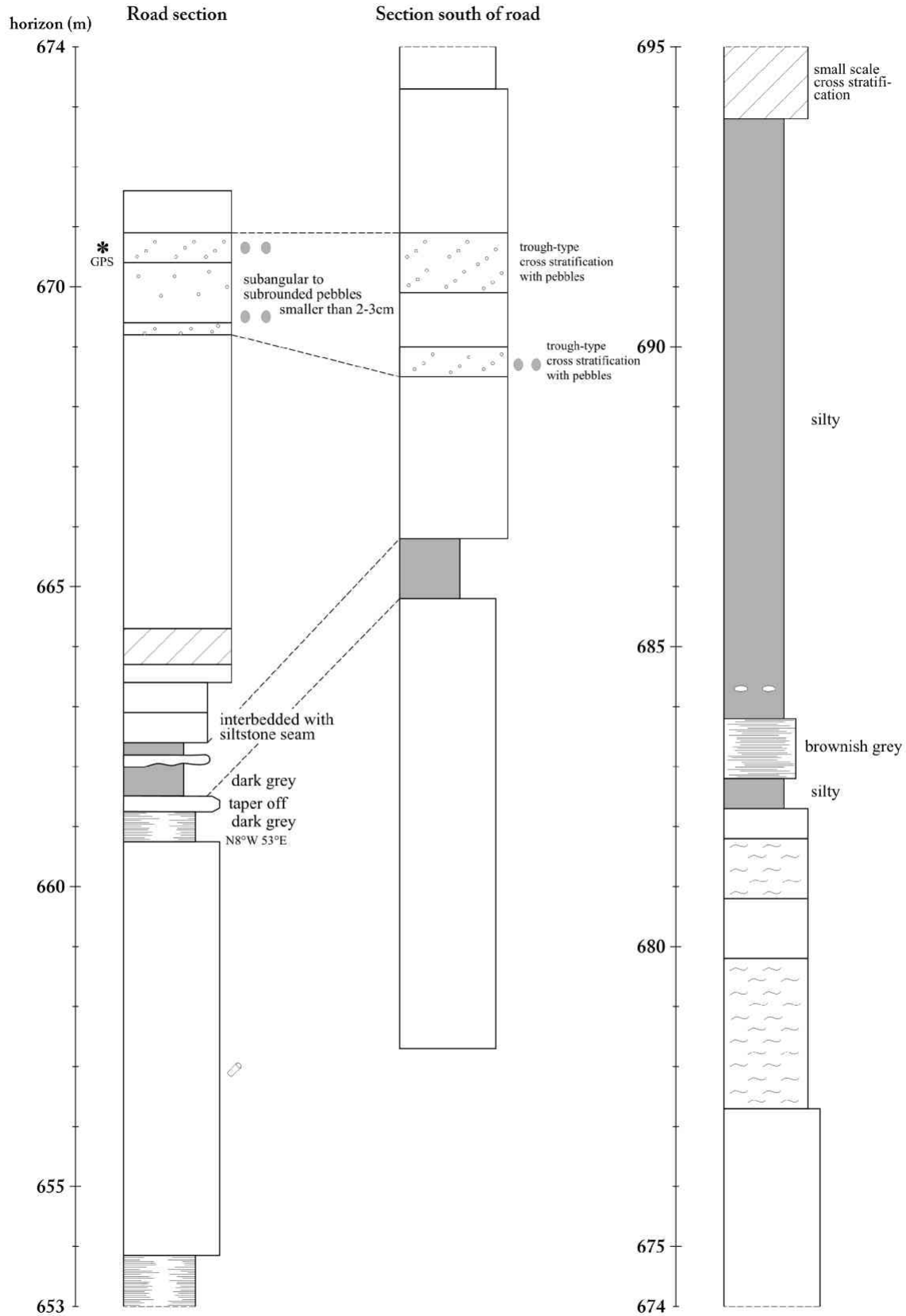


Figure 10. Lithologic column of the Pondaung Formation (9). Road section and section south of the road. Two sections are correlated by the gritty to pebbly sandstone horizon with trough-type cross stratification. Legend is the same as Figure 2. GPS-position of the outcrop with asterisk of the road section was measured as 21°27'3.5"N, 94°17'58.4"E.

Lithostratigraphy of the Pondaung Formation to the west of Pauk

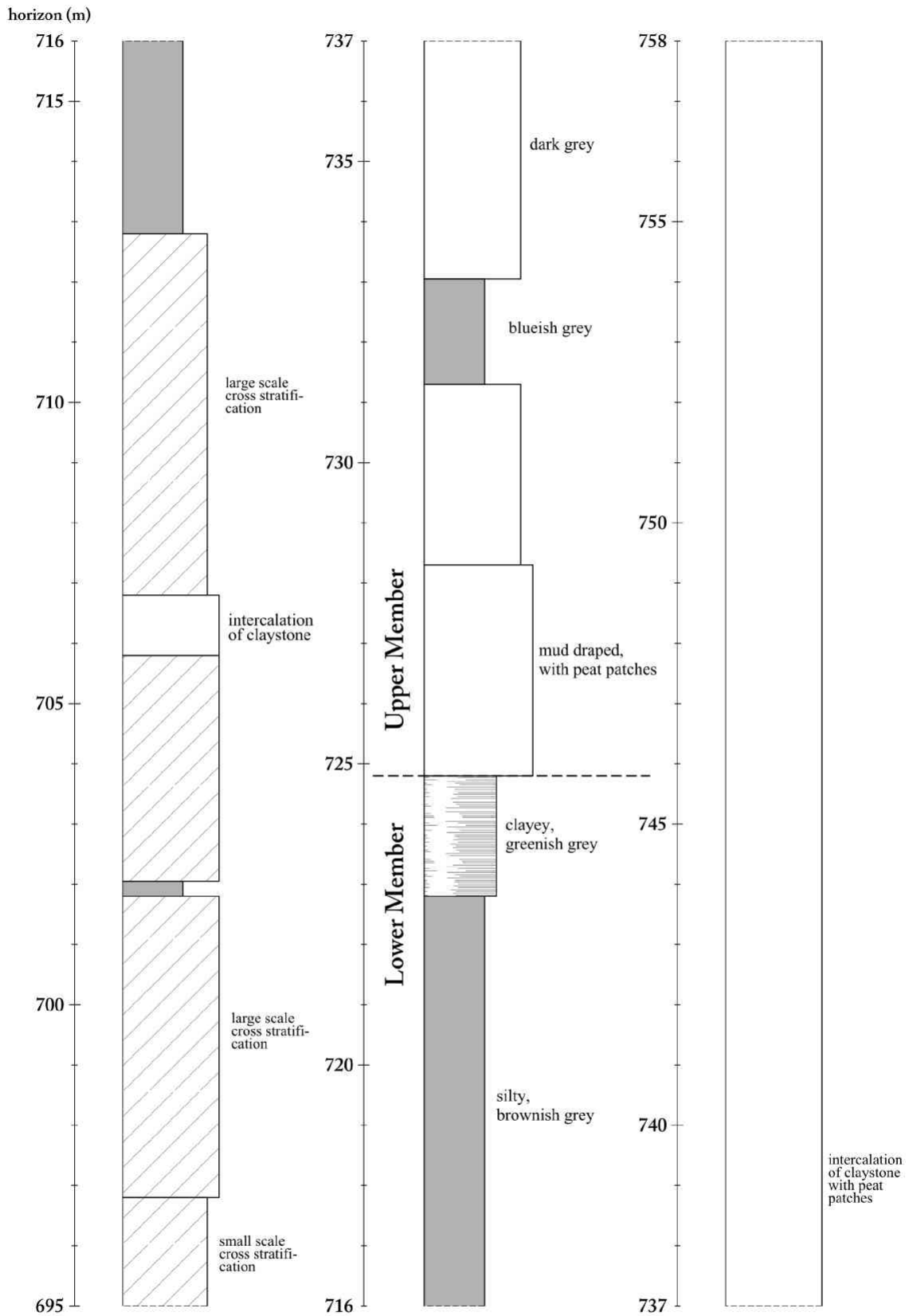


Figure 11. Lithologic column of the Pondaung Formation (10). Section south of the road. The boundary between the Lower and Upper Members is levelled at the horizon 724.8 m. Legend is the same as Figure 2.

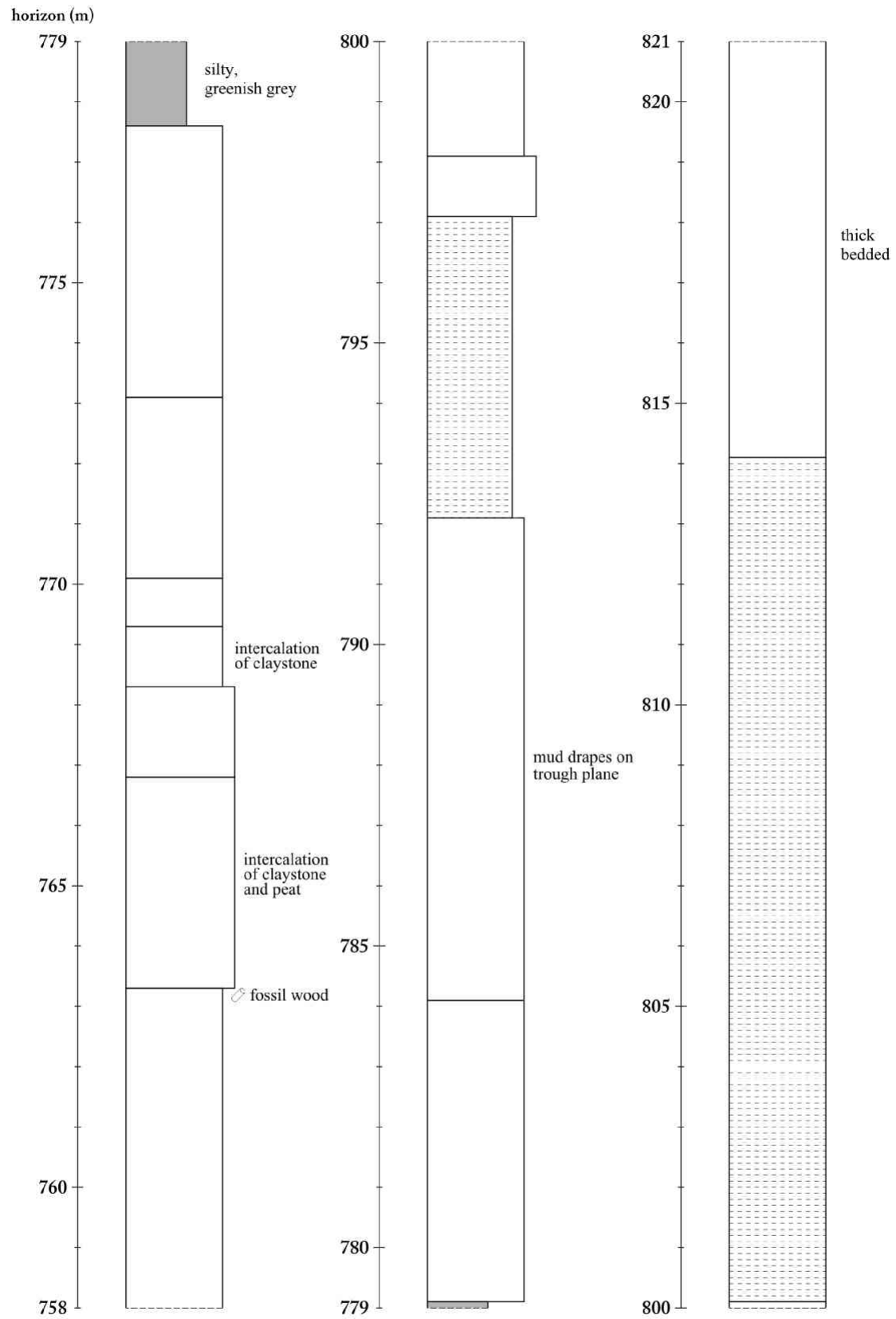


Figure 12. Lithologic column of the Pondaung Formation (11). Section south of the road. Legend is the same as Figure 2.

Lithostratigraphy of the Pondaung Formation to the west of Pauk

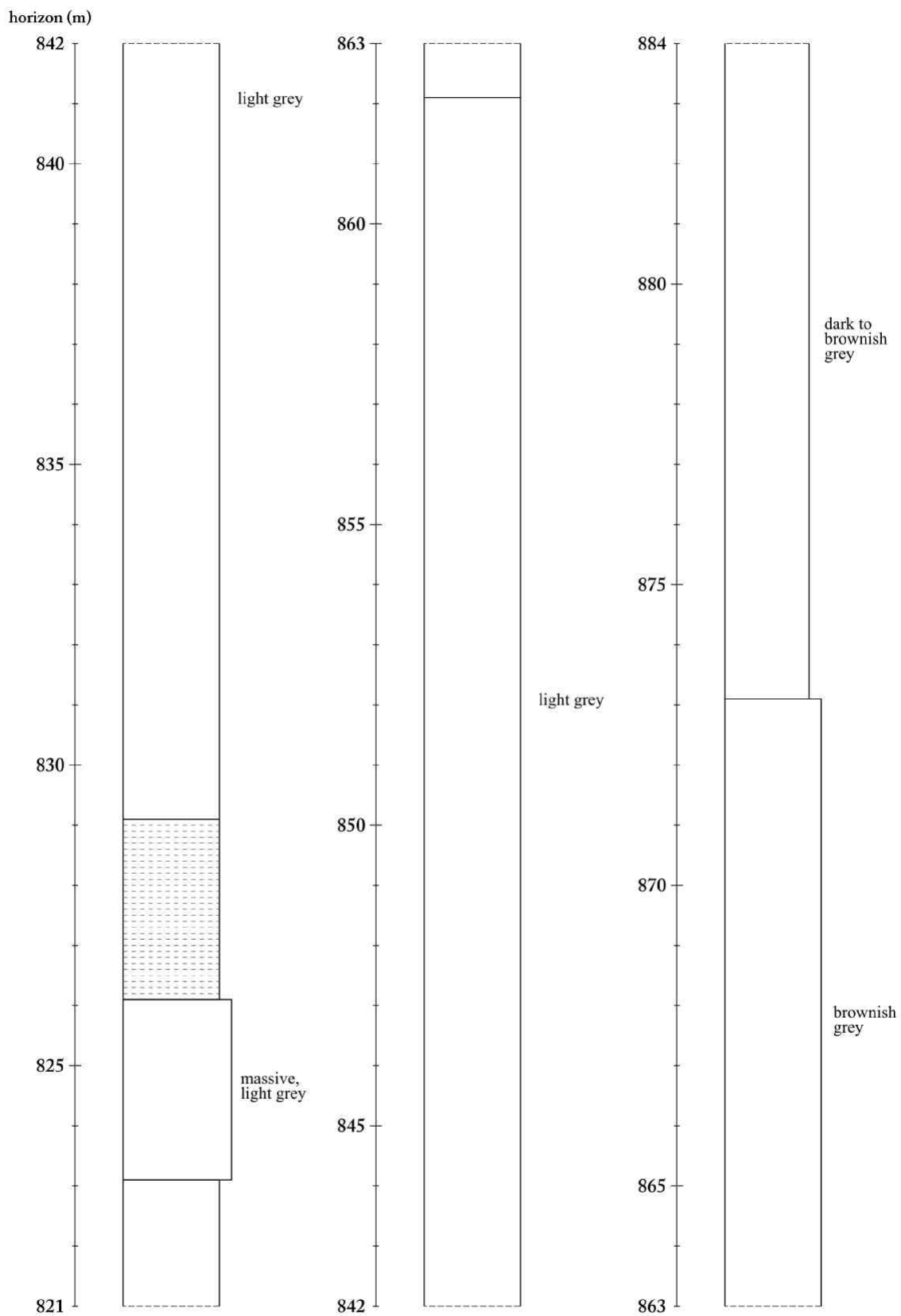


Figure 13. Lithologic column of the Pondaung Formation (12). Section south of the road. Legend is the same as Figure 2.

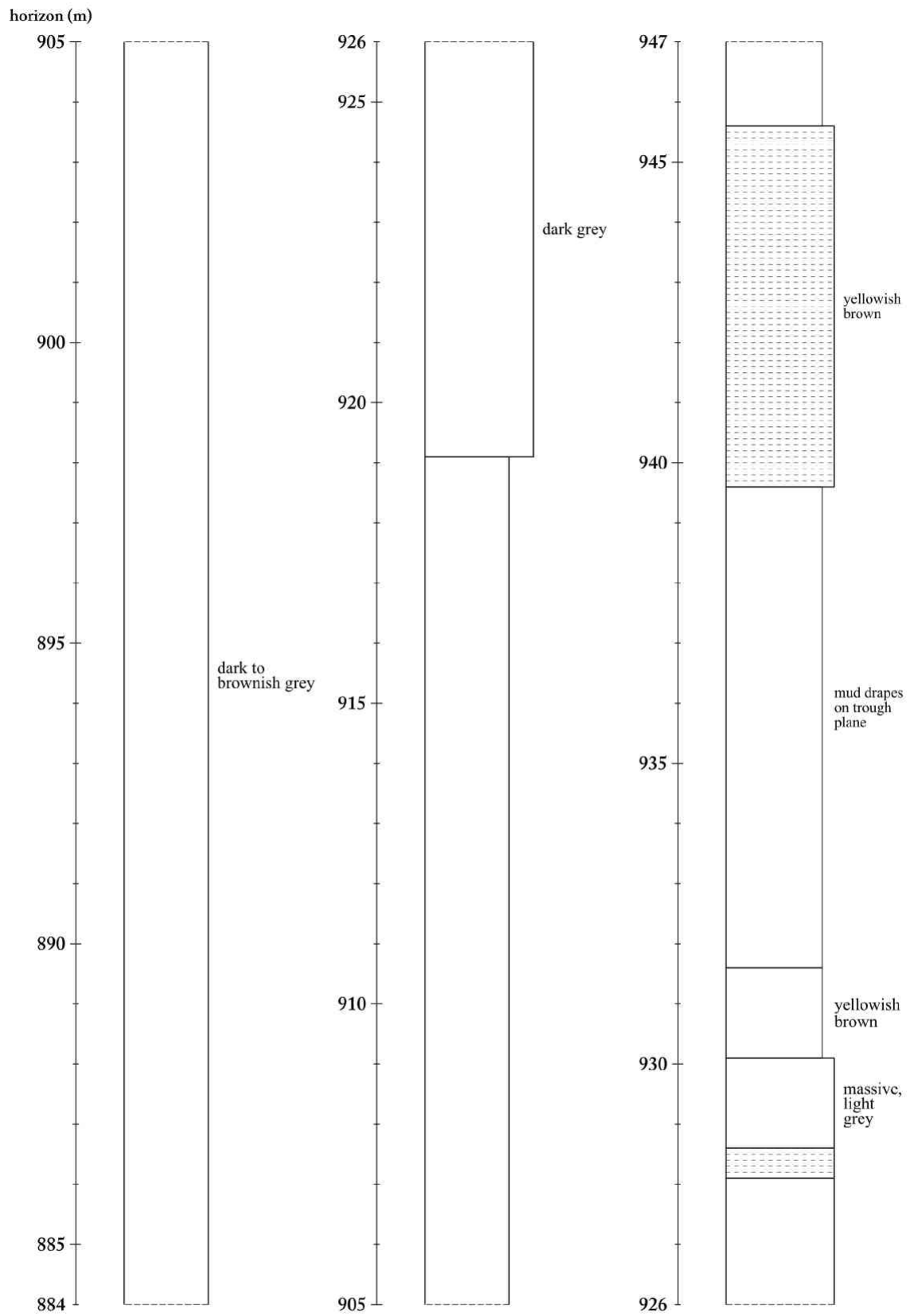


Figure 14. Lithologic column of the Pondaung Formation (13). Section south of the road. Legend is the same as Figure 2.

Lithostratigraphy of the Pondaung Formation to the west of Pauk

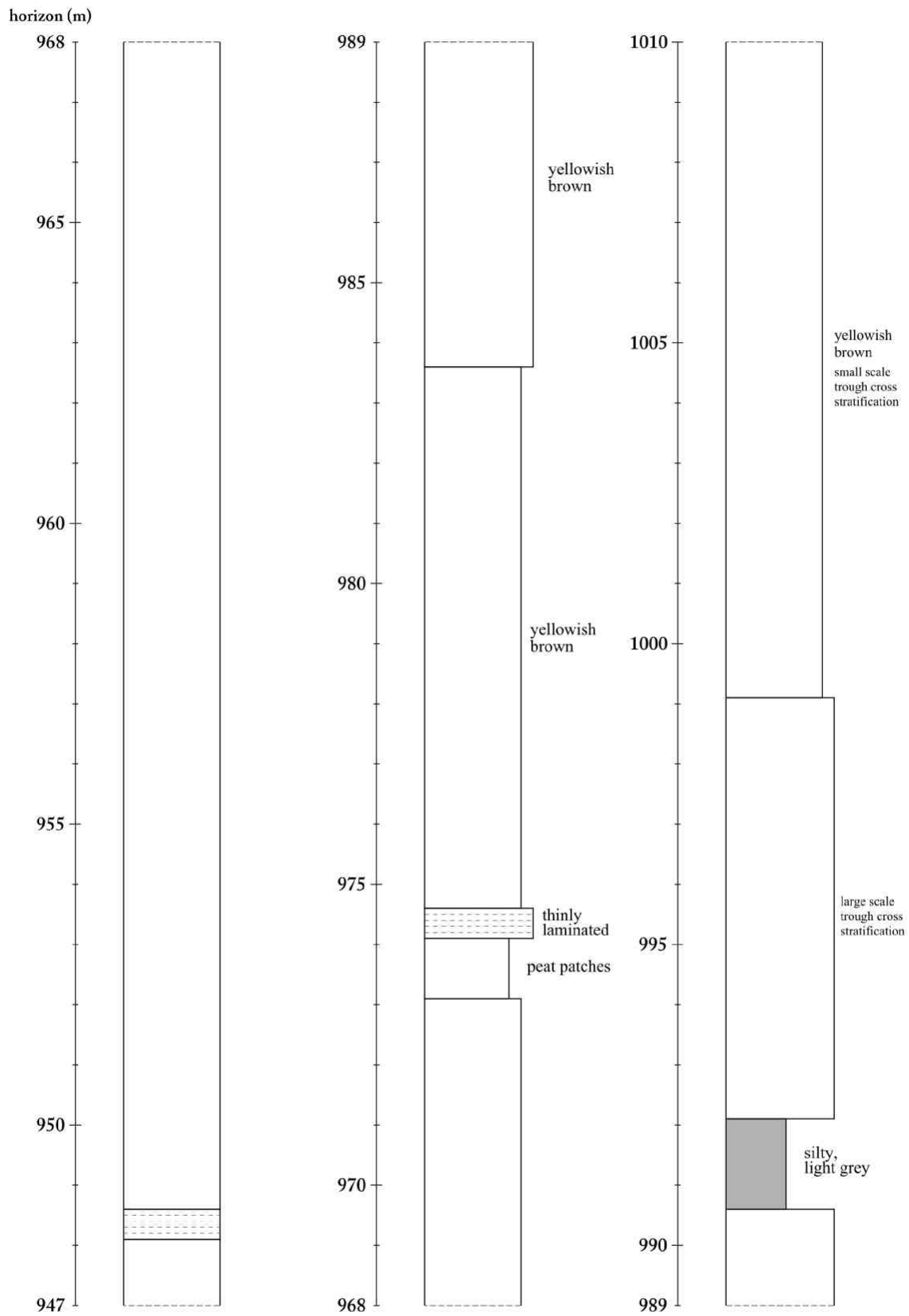


Figure 15. Lithologic column of the Pondaung Formation (14). Section south of the road. Legend is the same as Figure 2.

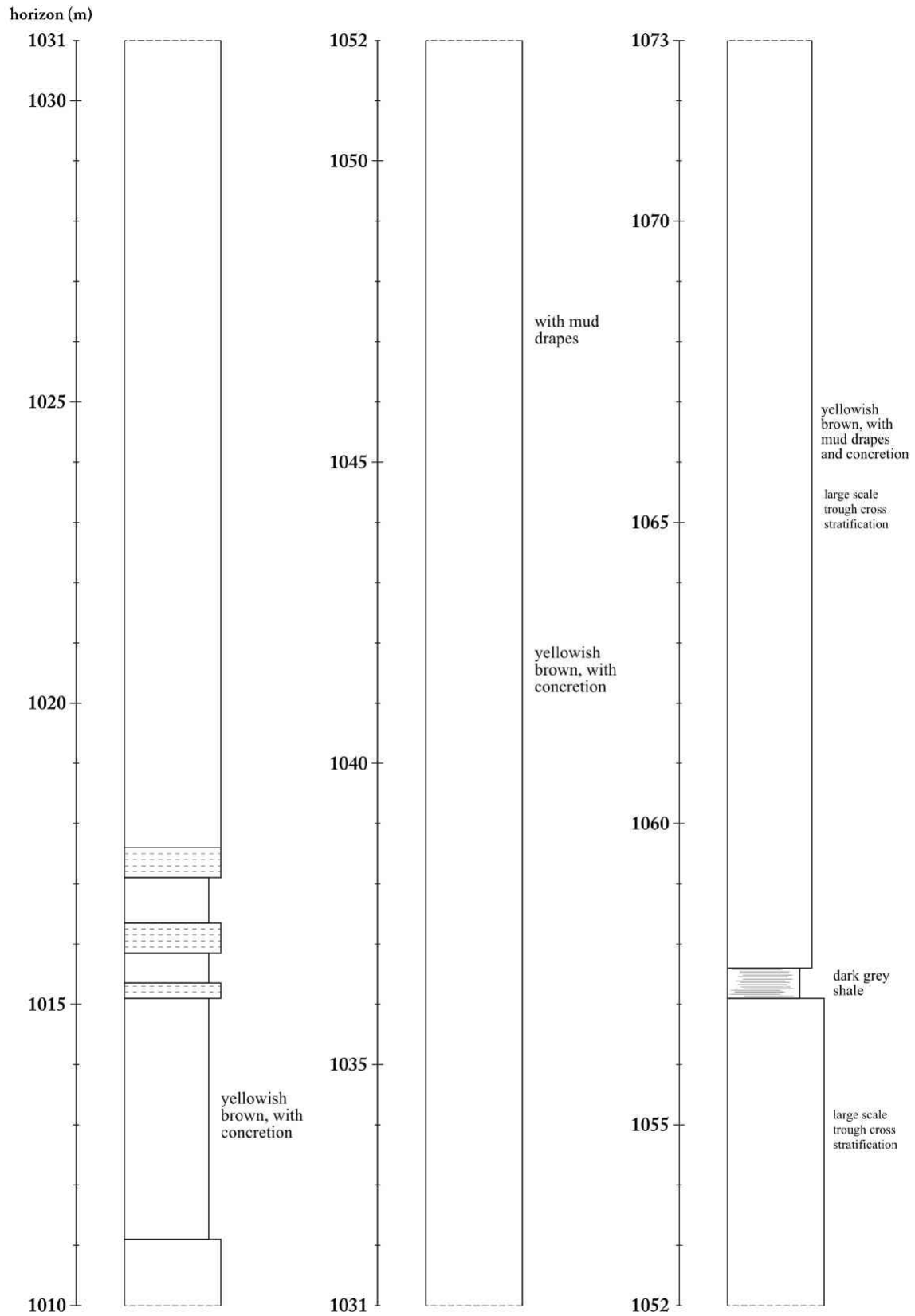


Figure 16. Lithologic column of the Pondaung Formation (15). Section south of the road. Legend is the same as Figure 2.

Lithostratigraphy of the Pondaung Formation to the west of Pauk

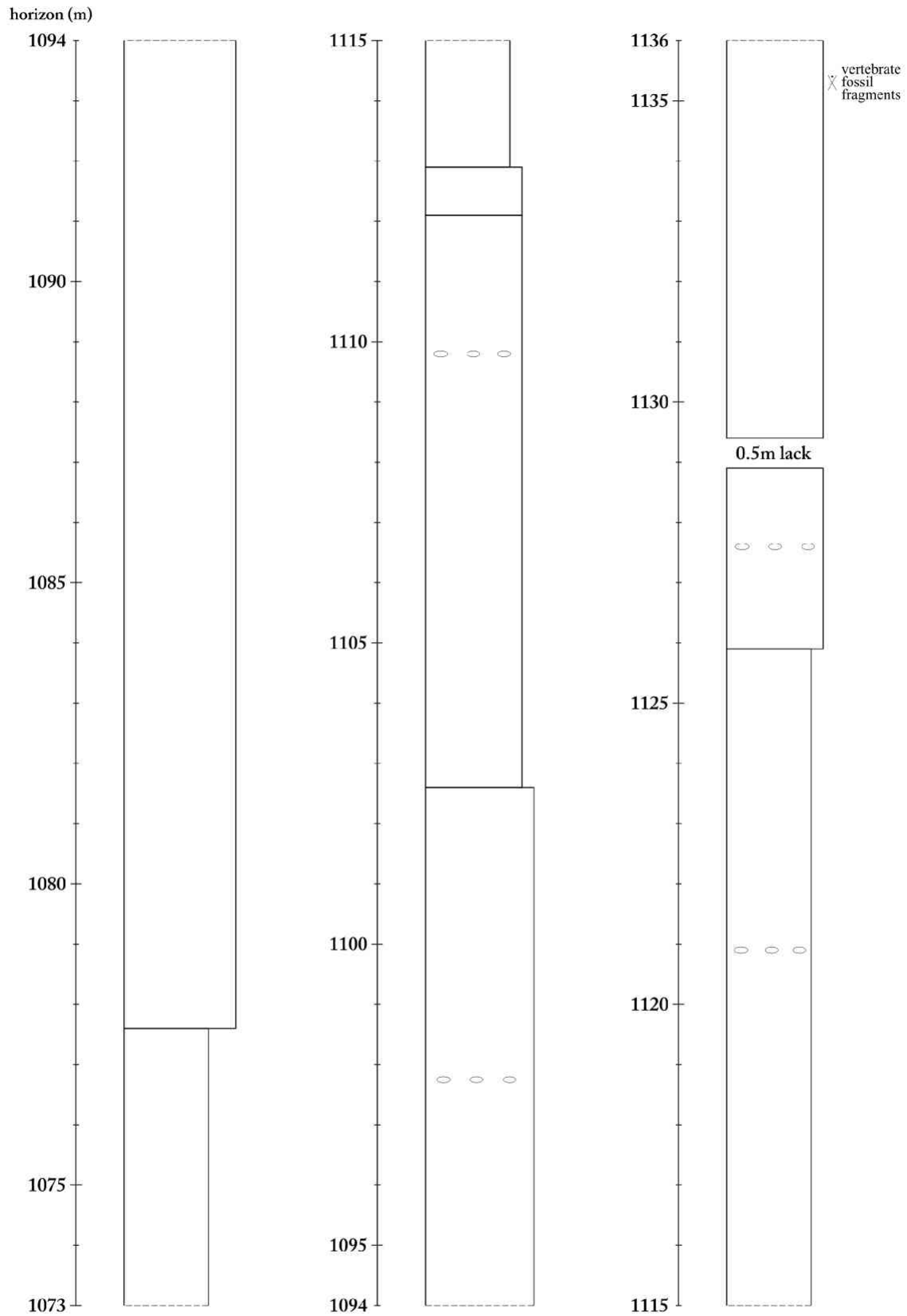


Figure 17. Lithologic column of the Pondaung Formation (16). Section south of the road. Legend is the same as Figure 2.

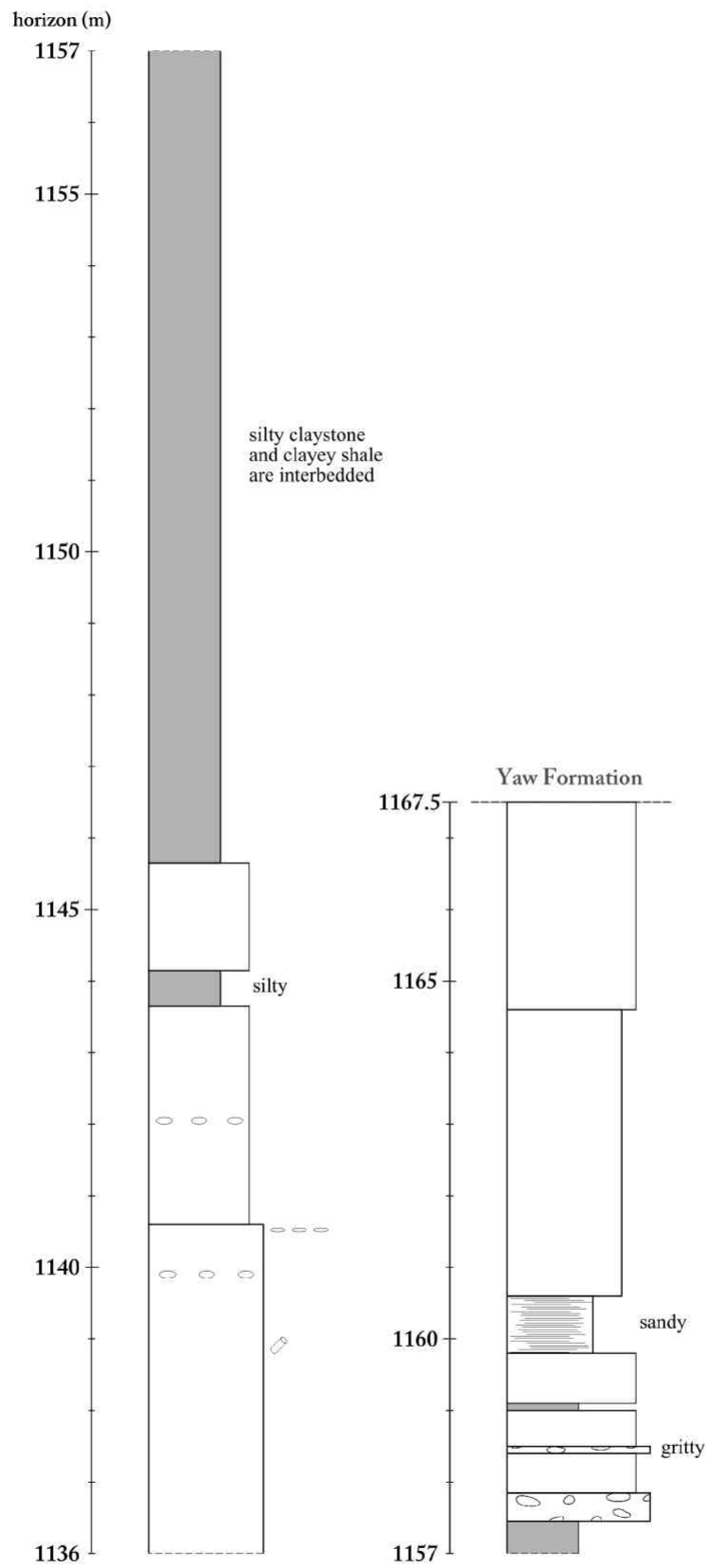


Figure 18. Lithologic column of the Pondaung Formation (17). Uppermost part of the Pondaung Formation. Section south of the road. Legend is the same as Figure 2.



Figure 19. Sandstone with the large-scale trough-type cross stratification. Horizon around 670 m. Road section.



Figure 20. Several mm to 3 cm pebbles on the trough plane of the sandstone (Figure 19). Horizon around 670 m. Road section.